Proceedings of the 53rd

FLORIDA DAIRY PRODUCTION CONFERENCE

Alto Straughn IFAS Extension Professional Development Center
Gainesville • Florida • April 20, 2017

FLORIDA
DAIRY PRODUCTION
CONFERENCE

UF|IFAS
UNIVERSITY of FLORIDA

Department of Animal Sciences
Institute of Food and Agricultural Sciences
University of Florida
Gainesville, Florida 32611

Proceedings of the

53rd Florida Dairy Production Conference

Thursday, April 20, 2017

Alto Straughn IFAS Extension Professional Development Center
2142 Shealy Drive
Gainesville, FL 32608

MISSION STATEMENT

The mission of the Florida Dairy Production Conference is to create a program which brings together some of the newest research, innovations, recommendations and ideas for improving the sustainability and profitability of the Florida dairy industry. The presented information provides practical take-home messages for dairy farmers and highlights emerging trends in the dairy industry. The conference strives to provide a friendly learning and sharing atmosphere with networking opportunities for our target audience of dairy owners and employees, allied dairy industry professionals, students and dairy educators.

PLANNING COMMITTEE

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Albert De Vries
Francisco Peñagaricano
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Proceedings from past Florida Dairy Production Conferences are available at http://dairy.ifas.ufl.edu

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JGM Consulting Agricultural Engineers	Joseph Martin	jake@dairydesign.com
Merck Animal Health	Joshua Churchwell	joshua.churchwell@merck.com
Mycogen Seeds	Marvin Stewart	mpstewart@dow.com
M&B Products	Dale McClellan	dale@mbproducts.com
NeoGen/GeneSeek	Ben Pejsar	bpejsar@neogen.com
Phibro Animal Health Corporation	Jacob Pieper	jacob.pieper@pahc.com
Select Sire Power	David Whitlock	dwhitlock@selectsirepower.com
Southeast DHIA	Brian Winters	brian.winters@dhicoop.com
Sunbelt Ag Expo	Chip Blalock	chip@sunbeltexpo.com
Suwannee Valley Feeds	Will Lloyd	will.lloyd@svfeeds.com
Westway Feed Products	Cathy Bandyk	cathy.bandyk@westwayfeed.com
Zoetis	Heath Graham	heath.graham@zoetis.com

Program

53rd Florida Dairy Production Conference

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Gainesville, Florida

9:00 AM	**Welcome and opening remarks** *Thomas Obreza* (Senior Associate Dean for Extension, University of Florida)
9:10	**Alternative strategies for improving feed efficiency and sustainability** *Michael VandeHaar* (Michigan State University)
9:50	**Improving efficiency of microbial growth in order to reduce protein feed costs for cows** *Timothy Hackmann* (University of Florida)
10:20	BREAK
10:50	**Lessons from 30 years working with dairy producers** *Art Donovan* (University of Florida)
11:30	**Effects of prepartum acidogenic salts on calcium and energy metabolism in transition cows** *Corwin Nelson* (University of Florida)
12:00 PM	LUNCHEON
1:30	**Genetic and non-genetic effects on embryo production technologies** *Peter Hansen* (University of Florida)
2:15	**Challenges, opportunities, and prospects of US dairy production** *Gordie Jones* (Central Sands Dairy, Nekoosa, Wisconsin)
3:00	BREAK
3:30	**The role of the modern dairy cow in improving the profitability of dairy production** *Greg Andersen* (Seagull Bay Dairy, American Falls, Idaho)
4:00	**Thinking outside the box: one Panhandle farm's quest for sustainability** *Meghan Austin* (Cindale Farms, Marianna, Florida)
4:30	**Producer panel** *Moderator: Albert De Vries*
5:00	RECEPTION

Alternative strategies for improving feed efficiency and sustainability

Michael J. VandeHaar, Michigan State University

with help from:
Kent Weigel and Louis Armentano, University of Wisconsin
Rob Tempelman, Michigan State University
Diane M. Spurlock, Iowa State University
Roel Veerkamp, Wageningen UR, NL
Charlie Staples, University of Florida

Funding was provided by Agriculture and Food Research Initiative Competitive Grant no. 2011-68004-30340 from the USDA National Institute of Food and Agriculture.

Outline and goals

Outline

1. Defining feed efficiency.
2. Breeding for optimal production and body size.
3. Using residual feed intake to further improve efficiency.
4. Managing for feed efficiency.

Goal: to spur the discussion about what kind of cow we want in the future

Ever-Green-View, 2/15/2010
2790 #F, 2140 #P in 365 d

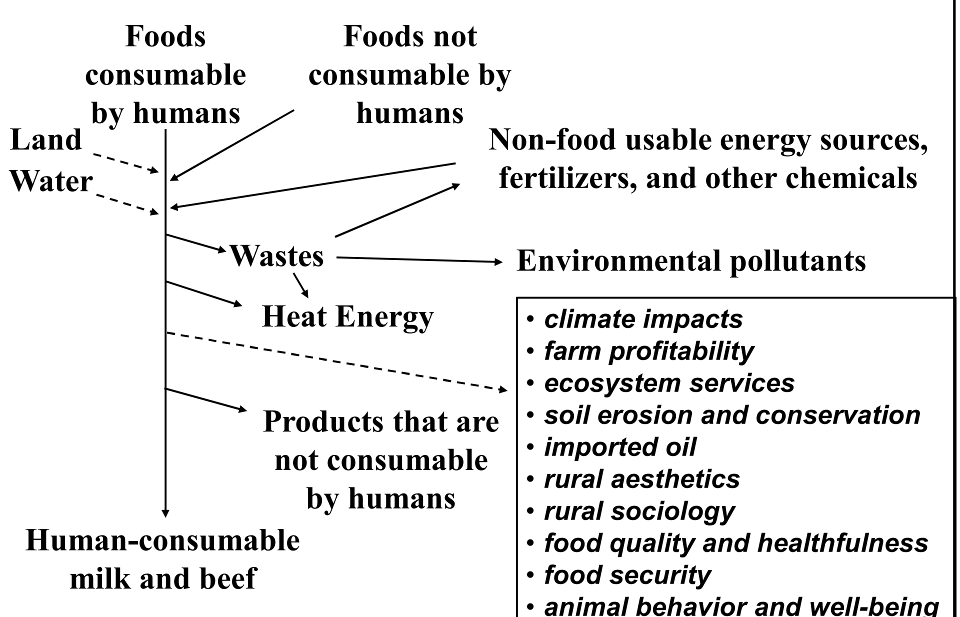
The modern dairy cow is a different beast!

Eurasian auroch

Modern Ideal Holstein Cow

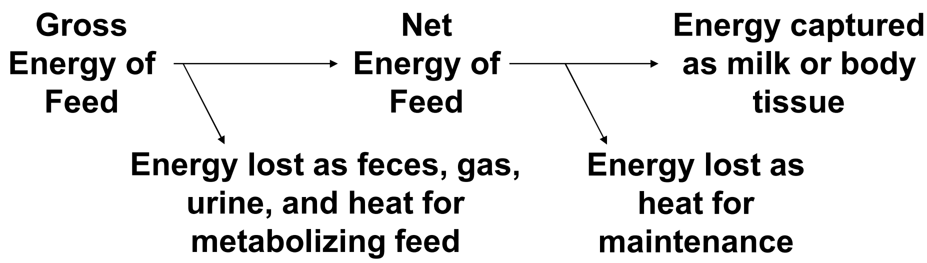
- We have been altering cattle genetics for 9000 years.
- Most selection was made based on animal's own phenotype.
- Population genetics (>1937) accelerated the progress.
- We made a lot of progress based on looks and a few numbers.
- Modern dairy cows are taller, thinner, and less muscular, and they have bigger udders.
- Today we have data. Lots of it.

Feed efficiency is a complex trait.



This is too complicated to use!

The basics of feed efficiency



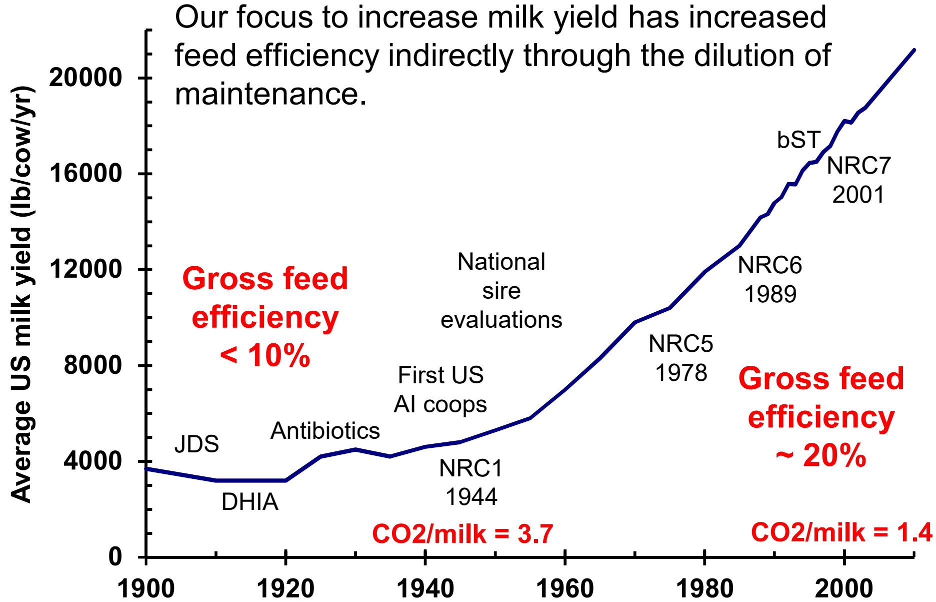
Gross feed efficiency is the percentage of feed energy captured in milk and body tissues.

To improve gross feed efficiency:

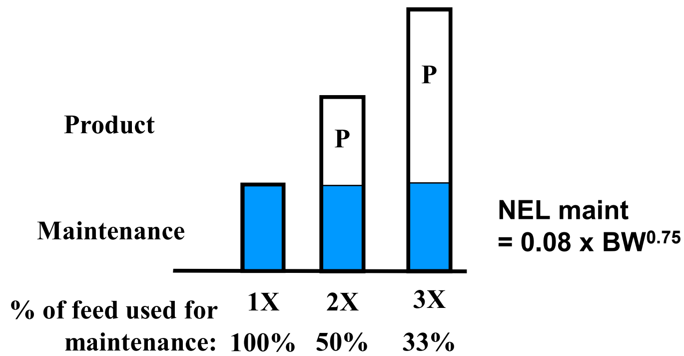
1. Increase the conversion of GE to NE
2. Increase milk production relative to maintenance.

Increased productivity in the past has resulted in increased efficiency

Our focus to increase milk yield has increased feed efficiency indirectly through the dilution of maintenance.

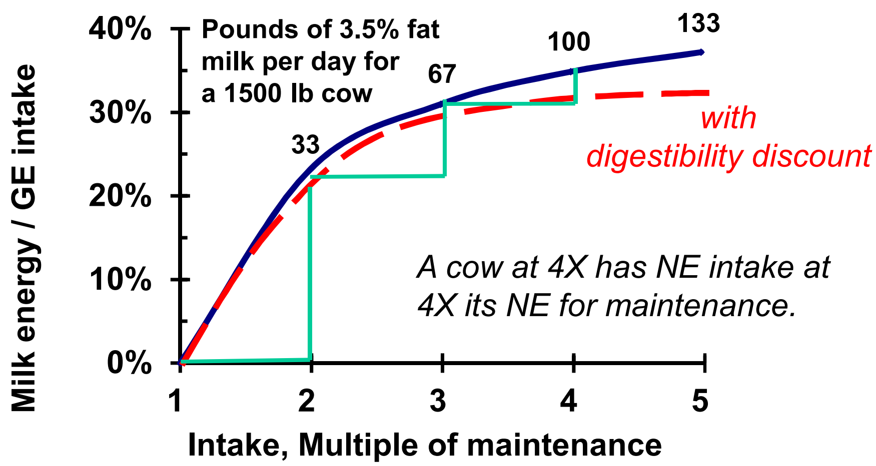


Efficiency increases from the "Dilution of Maintenance"



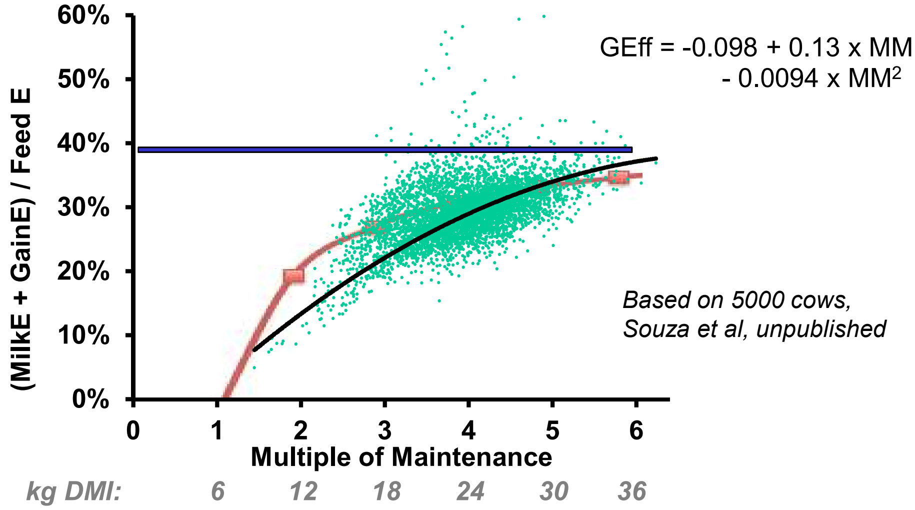
As cows eat more and produce more per day, a smaller percentage of the food they eat is used for maintenance and a greater percentage is converted to product.

The dilution of maintenance: past vs future



As productivity increases, gross efficiency increases but the incremental advantage diminishes. In addition, as cows eat more, they digest feed less efficiently, so this curve plateaus at ~5X.

Optimal production per unit BW based on current data



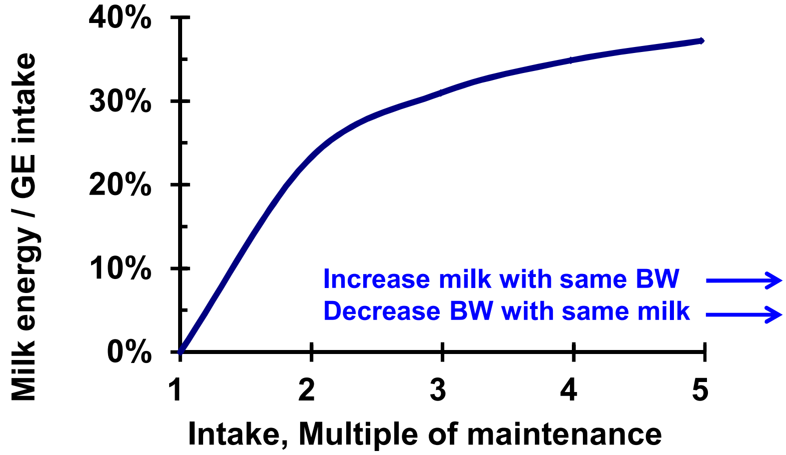
High producing cows per unit BW are more efficient.
The returns in efficiency from more milk are diminishing, but not as much as current NRC suggests!

Is there an optimal milk production and body size?

Feb 15, 2010: Wisconsin cow Ever-Green-View My 1326-ET became the national milk production record holder, at 4 yr 5 mo. of age. She produced a 365-day record of 72,200 lbs of milk, with 2,790 lbs of fat and 2,140 lbs of protein.

If a cow produces this much, I don't care if she weighs 2000 lb!

The dilution of maintenance: milk vs cow size



Whether we get more milk with the same BW or the same milk with a smaller BW, the cow is operating at a higher level and efficiency increases (but maybe not much).

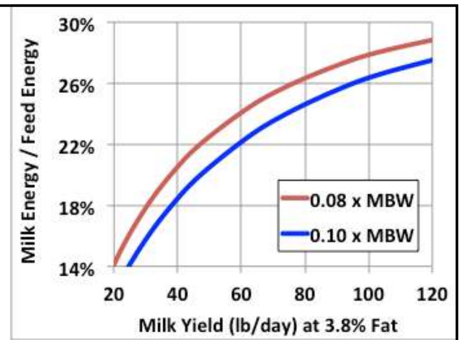
Maintenance requirement – what is it?

- NRC 2001: 0.08 x Metabolic BW
- Birnie et al., 2000: 0.084 to 0.113 x MBW
  depending on BCS
- Moraes et al, 2015: 0.086 to 0.115 x MBW
  depending on decade
- Tempelman et al., 2015: 0.11 to 0.17 x MBW
  depending on research farm

Maintenance for lactating cows varies with level of milk, body weight, and body condition score.

Holsteins are getting larger!

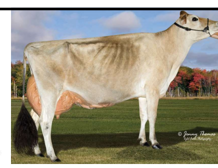
- Of current proven AI bulls in 2007, 62% were >1SD for stature and 3% were <1SD. (Anderson, 2007)



- Because of the 2014 base change, current AI bulls look average for stature, but "average" for Holsteins jumped 0.8 stature points in the last 2 years!
- Larger, more angular cows have more health problems. (Hansen, 2000)

➢ **Why select for cows that look like they can produce more milk when we can directly select for more milk?**

Jerseys vs Holsteins



J. Dairy Sci. 95:165–176
doi:10.3168/jds.2011-4360

A comparison of the environmental impact of Jersey compared with Holstein milk for cheese production[1]

J. L. Capper*[2] and R. A. Cady†

	Jersey	Holstein	H/J
Body Wt, lb	1000	1500	150%
Maint Reqt, Mcal/day	7.9	10.7	135%
Life Maint Reqt, Mcal/day	13	18	141%
Milk, lb/day	46	64	139%
Milk Energy, Mcal/day	18	22	119%
Life Cheese Yield, Mcal/day	28	33	118%
Life Multiple of Maintenance	3.2	2.8	89

Feed intake was not measured.

Jerseys vs Holsteins

317 Impact of milk yield, herd size, and feed efficiency on economic change between and within California dairies from 2006 through 2010. L. Rodriguez*[1], G. Bethard[2], D. Tomlinson[1], and M. McGilliard[3], [1]*Zinpro Corporation, Elk Grove, CA,* [2]*G & R Consulting, Blacksburg, VA,* [3]*Virginia Tech, Blacksburg.*

- Feed efficiency and profitability were similar for top Jersey and Holstein herds.
- Published data is lacking to decide if feed efficiency is actually different between the breeds.
- Holsteins better produce almost twice as much milk more protein and fat, or they will be less efficient than Jerseys! Both breeds should focus on production per unit BW.

Genetic (upper right)and non-genetic (lower left) correlations and heritabilities (diagonal) for efficiency traits on 5700 Holsteins. Lu et al., 2015

	MilkE	MBW	DMI	Gross Eff.		IOFC
MilkE	0.37 ±0.03	0.06 ±0.06	0.66 ±0.04	0.66 ± 0.08		0.97 ±0.01
MBW	0.22 ±0.04	0.51 ±0.03	0.45 ±0.05	-0.28 ±0.06		0.02 ±0.07
DMI	0.56 ±0.02	0.37 ±0.03	0.38 ±0.03	-0.11 ±0.04		0.54 ±0.06
Gross Eff.	0.39 ±0.02	-0.03 ±0.01	-0.19 ±0.02	0.13 ±0.00		0.70 ±0.05
IOFC	0.85 ±0.01	0.17 ±0.04	0.34 ±0.03	0.77 ±0.01		

Selection against body size will enhance feed efficiency but not milk income per cow. Selection for milk increases both.

Summary for body size and efficiency

Liu et al., 2015. Body weight.

- For 5700 Holsteins, body weight was not genetically correlated with milk energy per day. The genetic correlation of body weight with gross feed efficiency was -0.3.

Manzanilla-Pech et al., 2015. Stature.

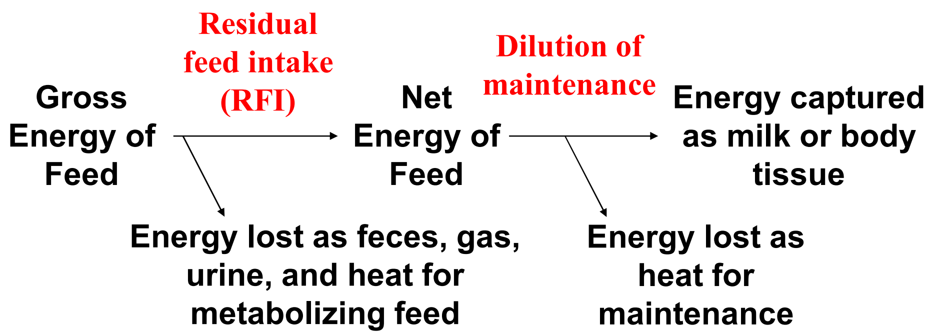
- For 1900 US Holsteins, stature was not genetically correlated with milk energy/day. The genetic correlation of stature with gross feed efficiency was -0.7 and with residual feed intake was +0.4.

- **Selecting for bigger, taller cows does not increase milk.**
- **Selecting for bigger, taller cows decreases feed efficiency.**

Other considerations in the size debate

- Milk solids yield (income per cow) is more important than size.
- Feed efficiency and profitability must be considered on a whole-farm basis.
- Smaller cows need less space so could have more cows per farm.
- Management time per cow is about the same.
- Bigger cows and their bull calves have more salvage value.
- Smaller cows might have fewer health problems.
- Smaller cows might handle heat stress better.
- Bigger cows might need less digestible diets (large herbivores can digest fiber better than small ones).

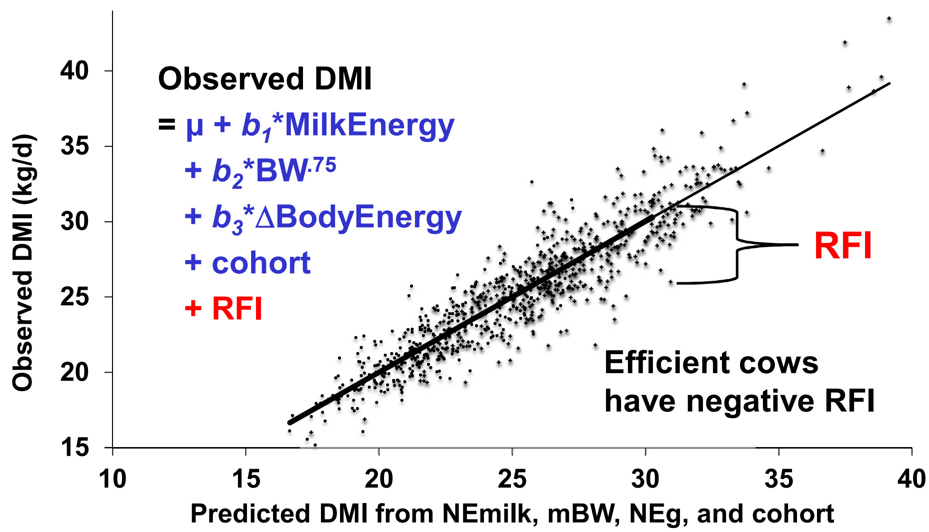
The basics of feed efficiency



To improve efficiency:

1. Increase the conversion of GE to NE
2. Increase milk production relative to maintenance.

Residual feed intake (RFI) = "unjustified" feed intake



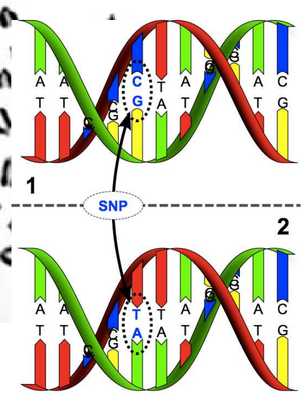
The heritability of RFI is 0.17, based on 4900 Holsteins from North America and Europe. (Tempelman et al., 2015)

RFI is a repeatable trait

- Diet: high starch vs high fiber
- Climate conditions
- Lactation number
- Lactation stage
- Heifer vs cow

Selecting genotypes today that are more efficient should provide more efficient cows in the future, even if they are on higher fiber diets in a hotter climate.

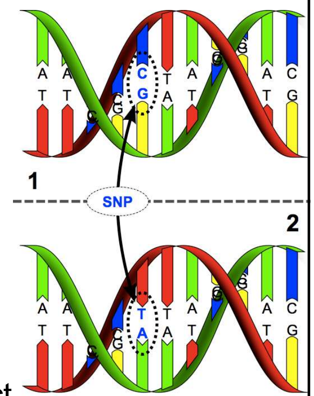
2 sets of 30 chromosomes,
with 3 billion base pairs per set



Traditional breeding values are based on daughter performance, but feed efficiency data are not available. Perhaps genomics can help.

Selection for RFI based on Single Nucleotide Polymorphisms (SNP)

- Genomics enables us to select for new traits and make decisions earlier on old ones.
- The SNP itself may have no biological effect, but it is linked to the DNA around it. If allele T is associated with a desirable trait, we can select for T and against C.
- Each single SNP may not have much effect, but additive effects of 1000s of SNP might.



from David Hall, 2007/en.wikipedia.org/wiki/File:Dna-SNP.svg

```
     SNP: 1 2 3 4 5 6 7...78000
Genotype: 1 1 2 0 0 1 0...   2
   Value: 0 2 3-3 0 0 8...  -1
    gPTA: 0 2 6 0 0 0 0...  -2    Sum = 650
```

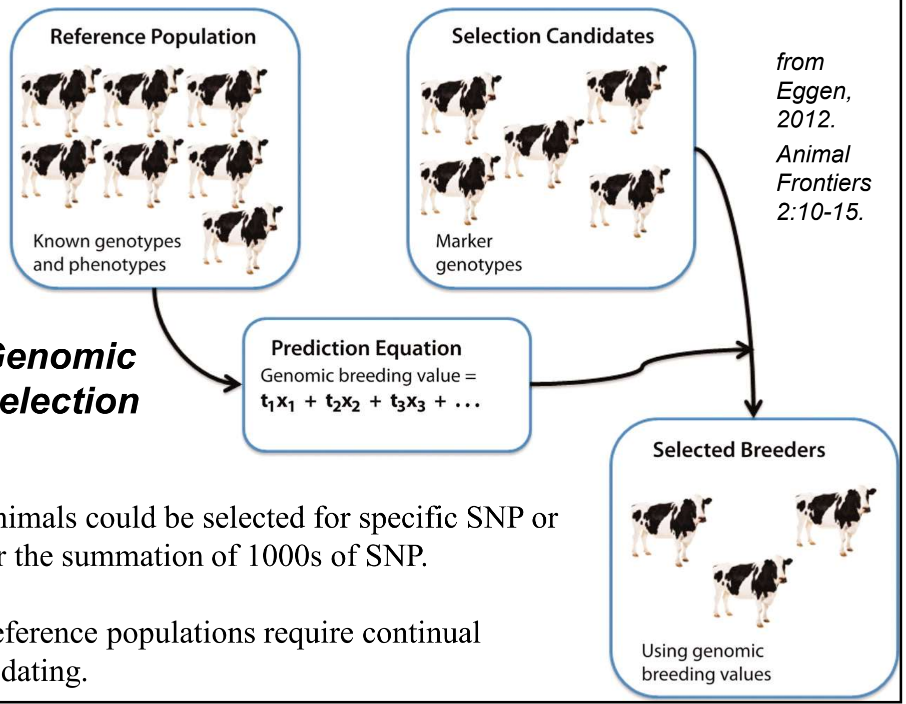
Preliminary genomic analysis for traits related to feed efficiency (2900 cows)

The mean and estimates of genetic variance (VarG), proportion of phenotypic variance accounted for by SNP (Mh^2), and Pi, such that 1-Pi represents the proportion of SNP fitted in the genome wide association analyses.

Trait	Mean	VarG	Mh^2	Pi
Dry matter intake, kg/d	22	1.5	0.26	0.93
Milk energy output, Mcal/d	27	3.3	0.22	0.91
Metabolic BW	119	23	0.38	0.92
BW change, kg/d	0.39	0.17	0.02	0.98
Residual feed intake, kg DM/d	0	0.27	0.14	0.91

Spurlock et al., 2014;
Results were similar with 4900 cows. Lu et al., 2017; Hardie et al., submitted

Genomic Selection



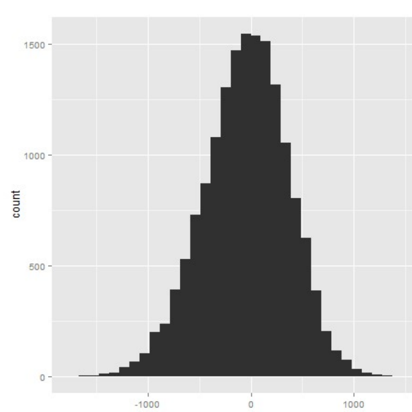
from Eggen, 2012. Animal Frontiers 2:10-15.

Animals could be selected for specific SNP or for the summation of 1000s of SNP.

Reference populations require continual updating.

Preliminary genomic results of efficiency traits for North American bulls. (Yao et al., 2016)

- Breeding values for 16,000 Holstein AI bulls in North America were predicted from a reference population of 3,500 cows.
- 57,000 SNP markers per animal were analyzed.
- Heritabilities were similar to what we previously reported.
- A “Feed_Saved” trait was calculated based on RFI and BW. Selection for this trait looks promising.
- Feed saved/yr
  = -(RFI + 2.1 lb per extra lb BW
- Reliability of EBV for RFI = 0.29



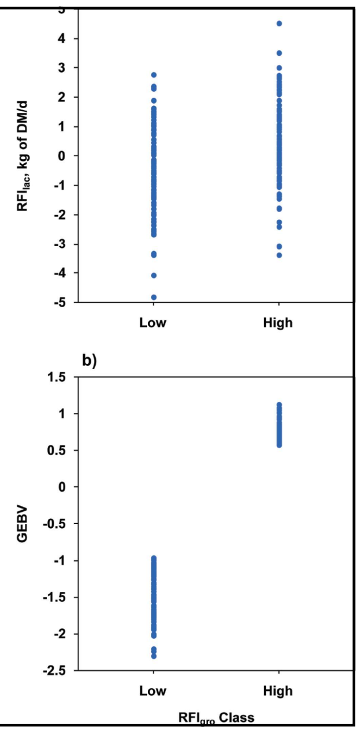
BV ranged from -2200 to +2200 lb/lactation.

Genomic selection for RFI can work

- Genomic Breeding Values for RFI were developed in growing heifers. Cows that were identified as being more efficient based on these GEBV did in fact need less feed to make milk. *(Davis et al., 2014)*

- Australia is now using genomic breeding values for RFI in combination with breeding values for smaller BW per unit milk in a "Feed Saved" index

- Netherlands is now using Genomic Breeding Values for DMI.



Net Merit (NM$) – Selection Index

	1971	2010	2014	2019?
Milk Yield	52	0	-1	
Fat Yield	48	19	22	15
Protein Yield		16	20	13
Productive Life		22	19	18
Somatic Cell Score		-10	-7	-8
Udder Composite		7	8	6
Feet/legs Composite		4	3	3
Body Size Composite		-6	-5	-5
Daughter Pregnancy Rate		11	7	9
Cow Conception Rate		-	2	
Heifer Conception Rate		-	1	
Calving Ability		5	5	5
Unjustified Feed Intake				-18

Summary on selection for efficiency

- To increase total feed efficiency and profitability, we want cows that eat and produce at a higher multiple of maintenance.
- We need to stop breeding for large cows just because they look nice. Instead we should breed for cows that produce more milk solids per unit of BW.
- In the near future, we will select directly for feed efficiency, using genomic breeding values for RFI in combination with breeding values for smaller BW per unit milk in a "Feed Saved" index.

Managing for greater feed efficiency

Ad lib TMR feeding has helped increase milk production but decreased the focus on individual cow needs.

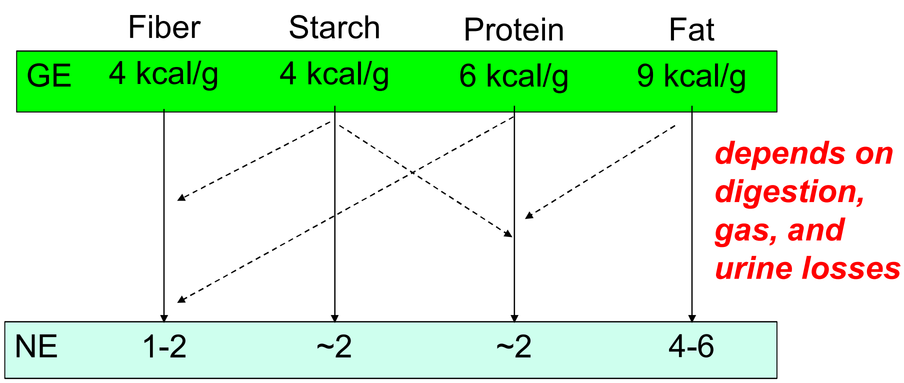
Feeding cows to meet their potential without overfeeding is key.

Grouping cows by feed needs improves feed efficiency and profitability, but grouping requires more work for management.

The farm team must work together and strategize:

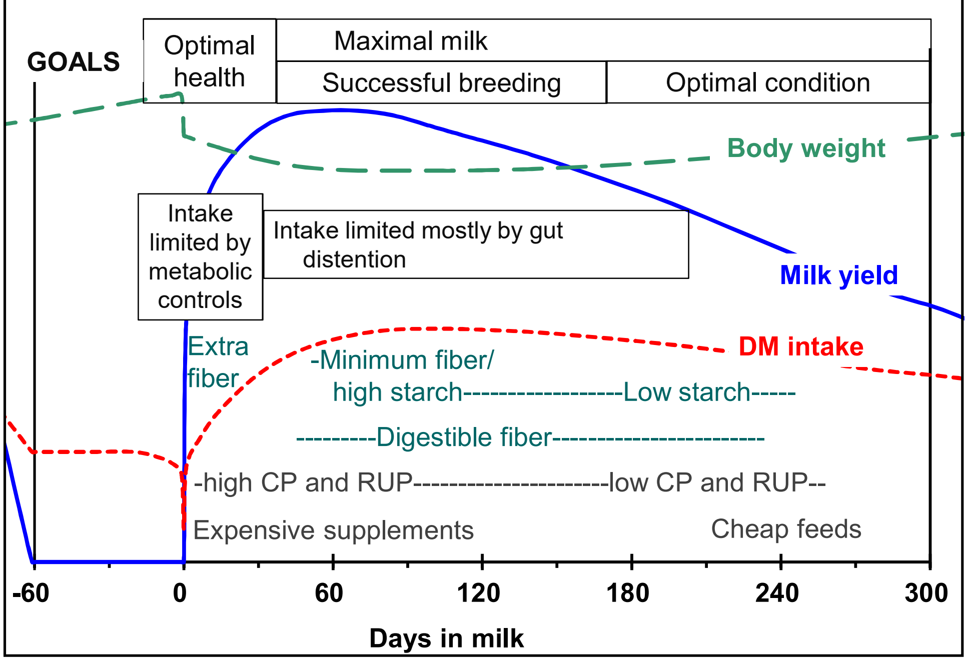
How can we promote production and efficiency of feed use?

Should milk/feed be a goal in feeding?



- Each nutrient class also alters feed intake and partitioning between body stores and milk, and thus efficiency.
- These effects cannot be modeled. We must assess what is happening on the farm!
- Diets that increase feed efficiency may not increase profits!

Optimal feeding through a lactation cycle



Nutritional grouping

In a survey of 400 farms, Contreras-Govea et al. (2015) found the 2 major constraints to nutritional grouping were:

- "It makes things too complicated"
- "Low diets decrease milk yield"

Dairy feeding goals:

- ➢ develop diets that meet needs for fresh, peak, and maintenance groups using published data
- ➢ use supplements, metabolic modifiers, feed additives, and cheap feeds to improve efficiency within groups
- ➢ make rules based on milk and BCS for moving cows and design systems to track cows
- ➢ develop protocols for feeding an extra diet
- ➢ consider computer feeders for high cows within a group
- ➢ track cow responses and make decisions based on them

Maintenance diets

- Several studies show this works! *(Oba and Allen, 1998; Ipharraguerre et al., 2002; Voelker and Allen, 2003; Bradford and Allen, 2004; Boerman et al., 2015)*
- Use high quality forages (digestible fiber) as the base.
- Drop the starch to 10-20%.
- Use slowly fermenting starch sources (ground dry corn).
- Include high fiber byproduct feeds at 20-30%.
- Consider fat if the price is right
- Drop %CP 2 units to increase N efficiency and save money.
- Drop out expensive ingredients that are most effective for the high group.
- Pay attention to prices! The goal is to increase income over feed costs in the short run and health in the long run!

Take-home points.

Point 1: Efficient cows produce a lot of milk for their size!

Point 2: Efficient cows efficiently convert feed to net energy.

What can we do?

- Breed for milk and moderate reductions in cow size.
- Feed and manage for high production over the lactation (one diet cannot do this).
- Consider selecting for low RFI or "Feed Saved" when it becomes available.

We want more than just efficiency

Our goal is a cow that efficiently converts feed to milk

- has high GE to NE (low RFI) because of greater digestibility, greater % of DE to NE, or lower maintenance
- efficiently captures (partitions) lifetime NE to product because she operates at a high multiple of maintenance
- is profitable (high production dilutes out farm fixed costs)
- has minimal negative environmental impacts

AND

- is healthy and thrives through the transition period
- yields products of high quality and salability
- is fertile and produces high-value offspring
- is adaptable to different climates and diets
- can use human-inedible foods, pasture, and cheap feeds
- can digest feeds better
- requires less protein and phosphorus per unit of milk
- has a good disposition and looks happy to the general public

NOTES

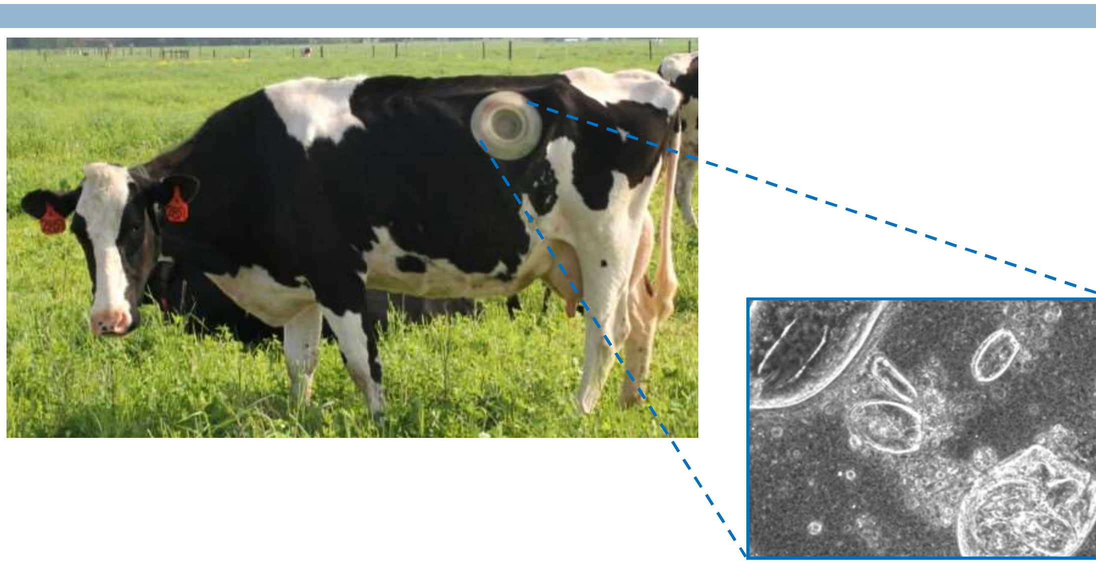
Improving efficiency of microbial growth

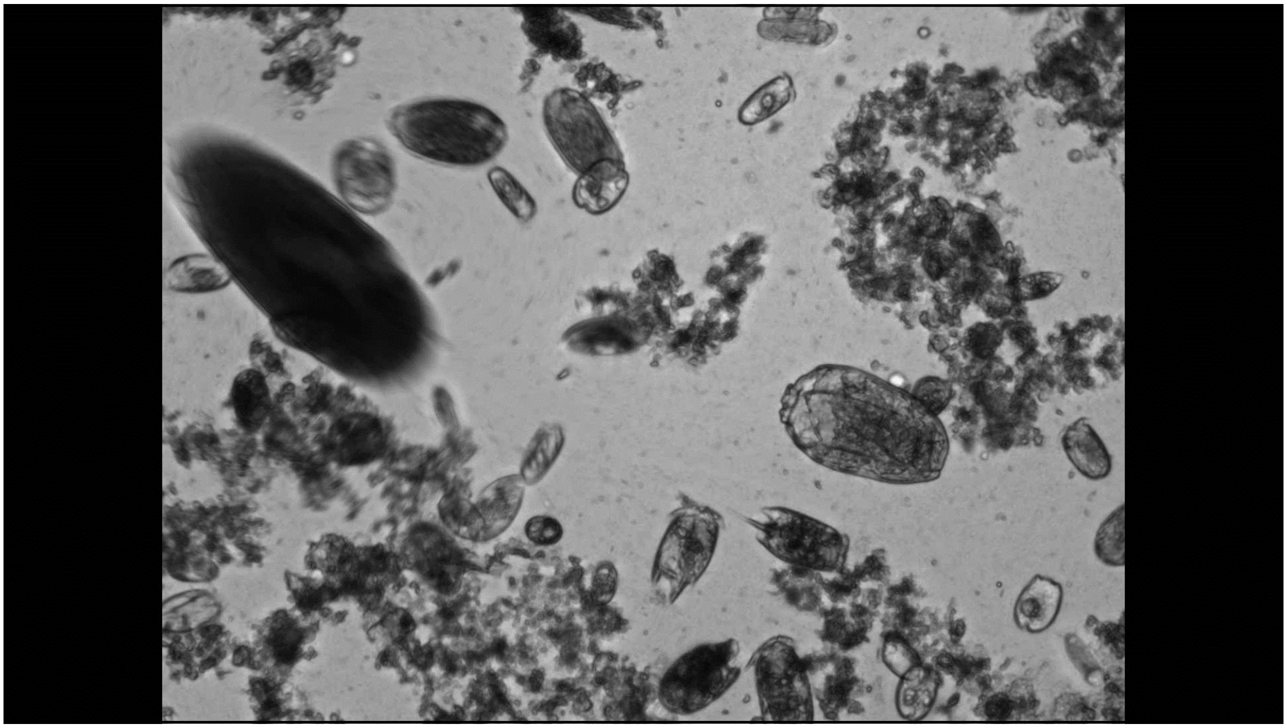
in order to reduce protein feed costs for cows

UF UNIVERSITY of FLORIDA

Timothy J. Hackmann
Department of Animal Sciences

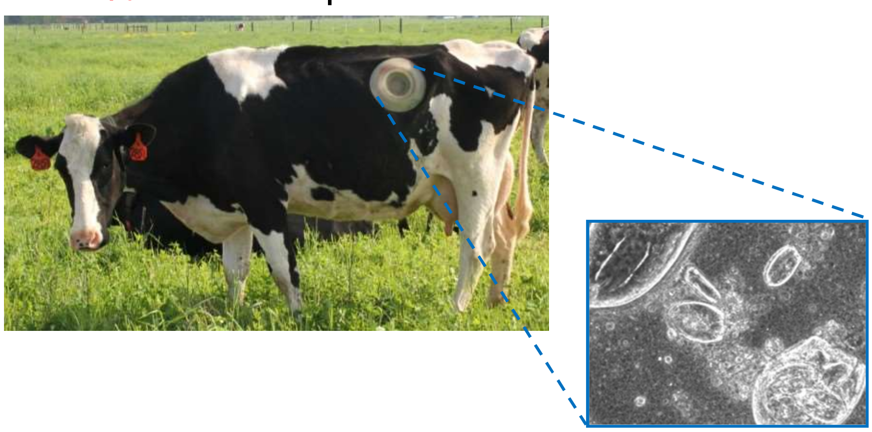
The unseen importance





The unseen importance

- Microbial protein
  - >50% animal requirements



Inefficiency

- Microbes use only **1/3** to **2/3** cellular energy (ATP) for protein synthesis (growth)

Inefficiency

Table 1. Efficiency of rumen microbial growth

System	Efficiency	
	g microbial DM (mol ATP)$^{-1}$	% theoretical maximum
Mixed microbes, in vivo	11 to 21	34 to 66
Mixed bacteria, in vitro	8 to 17	23 to 52
Pure cultures, in vitro	10 to 25	31 to 78

Economic impact

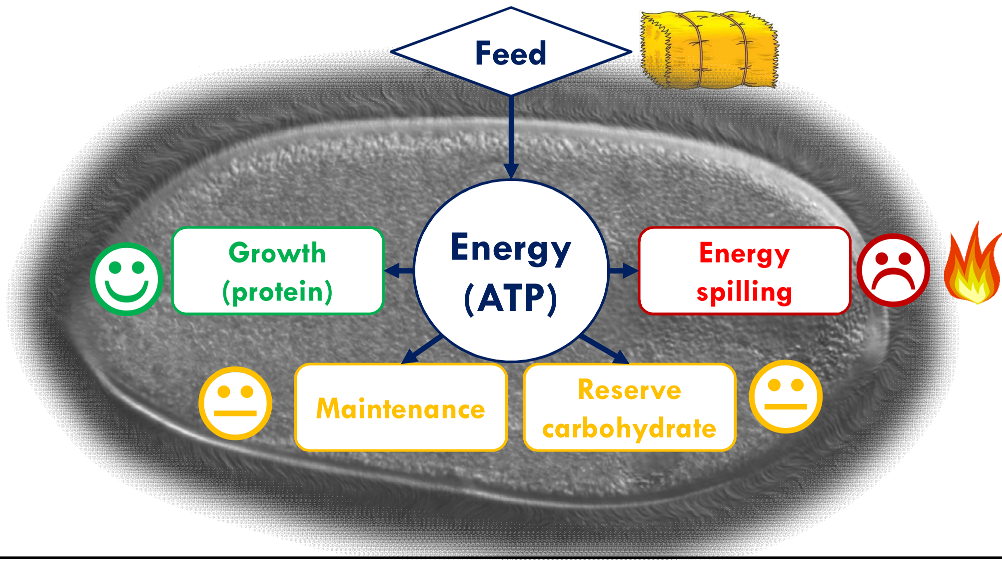
- Potential for increased efficiency
  - 150 to 300% if all energy used for growth
- If efficiency by only ↑5%
  - ↑0.17 lb microbial crude protein/cow/d
  - ↓$0.034/cow/d
    - $1.5 million/yr for Florida
    - $115 million/yr for US

Inefficiency

- Microbes use only **1/3** to **2/3** cellular energy (ATP) for protein synthesis (growth)

Where is the rest going?

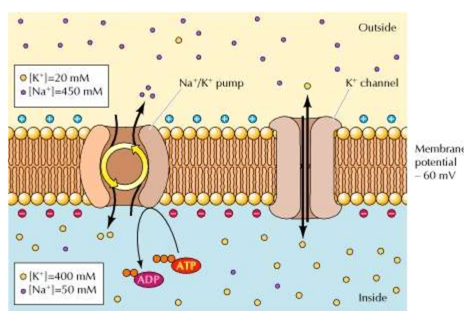
Inefficiency—cellular view



Energy sinks

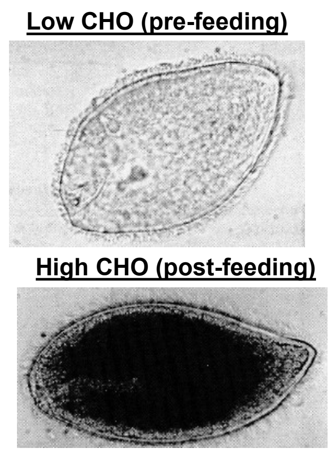
- Maintenance
  - Cost of living
  - Net product is heat

Maintenance of ion gradients



Energy sinks

- Reserve CHO
  - Up to 50% cell mass
  - May seem economical, but storage inefficient

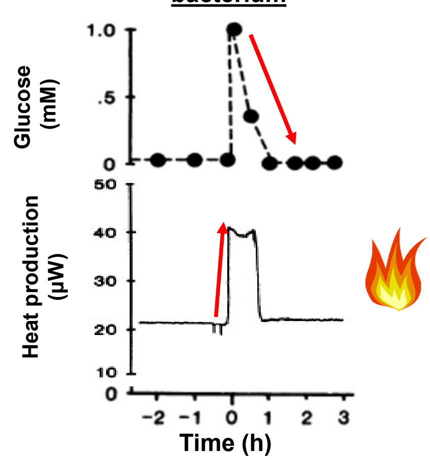


Williams & Coleman. 1992. The rumen protozoa

Energy sinks

- Energy spilling
  - Burning energy for the sake of burning energy

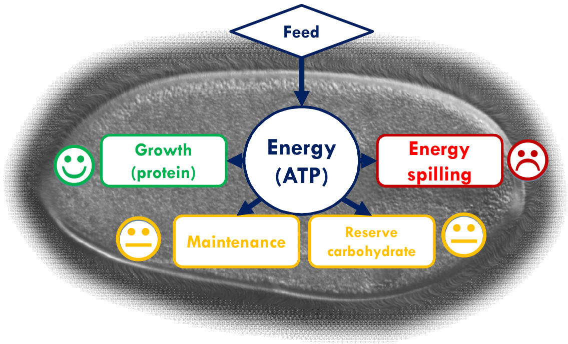
Energy spilling in a rumen bacterium



Russell. 1986. J Bact. 168:694

Problem

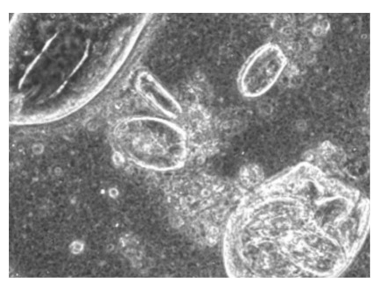
- Energy sinks
  - Seldom studied in mixed microbes from rumen
  - Relative importance not quantified



Previous work

- Mixed rumen microbes waste excess energy through
  - Reserve carbohydrate
  - Spilling

Mixed microbes

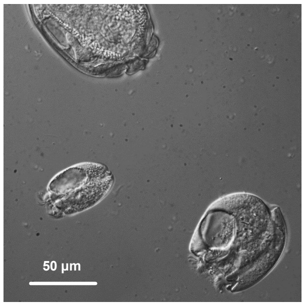


Hackmann et al. 2013. Appl Environ Microbiol. 79:3786

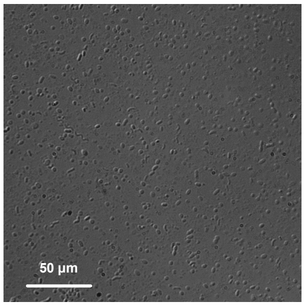
Unanswered question

- How do individual groups waste excess energy?

Protozoa



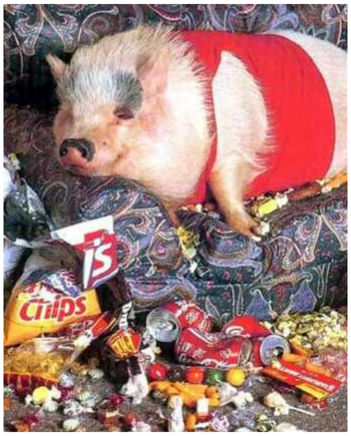
Bacteria



Objective

- Quantify how protozoa vs. bacteria waste excess energy
  - In vitro experiment
  - Energy provided in form of carbohydrate (glucose)

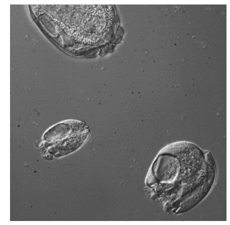
Carbohydrate excess



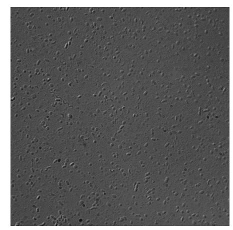
Hypothesis

- Compared to bacteria, protozoa
  - Waste more energy via storing **reserve carbohydrate**
  - Waste less energy via **spilling**

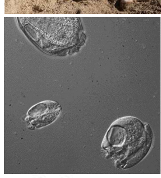
Protozoa

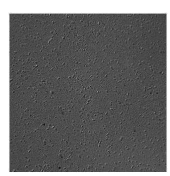


Bacteria



Methods





Rumen fluid (1 of 2 cows)

↓ -Filter or centrifuge

Protozoa or bacteria

↓ -Dose glucose (5 m*M*)

Energy use (heat production) by calorimetry

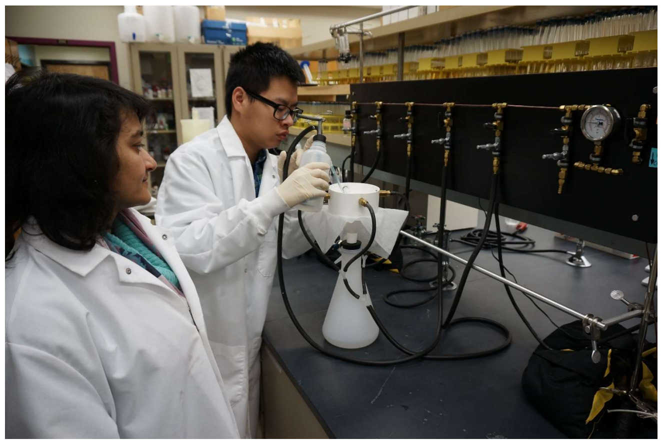
Chemical analysis
-Glucose
-Reserve carbohydrate
-Others

↓

Reserve carbohydrate, spilling, maintenance

Methods

Separation of protozoa

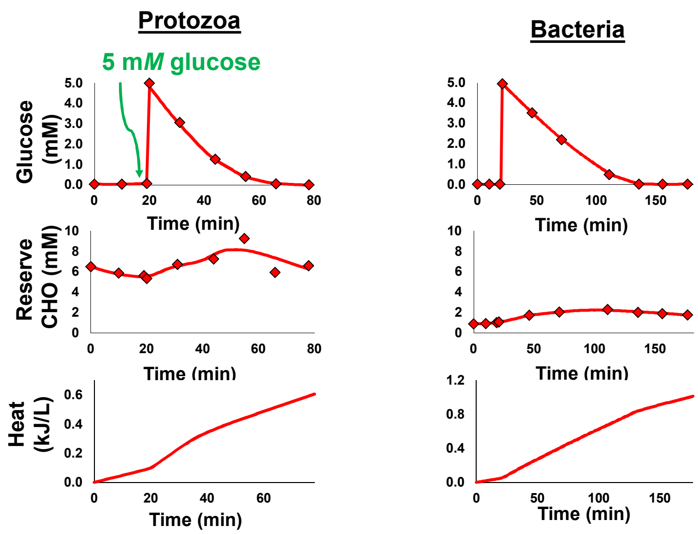


Methods

Calorimeter

Gas analyzer

Results

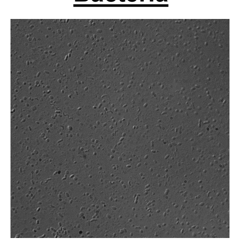


Hypothesis

- Compared to bacteria, protozoa
  - ✓ Waste more energy via synthesizing **reserve carbohydrate**
  - ? Waste less energy via **spilling**

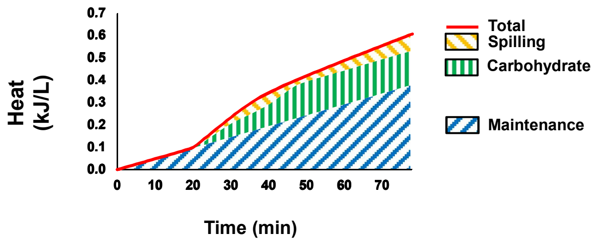
Protozoa

Bacteria



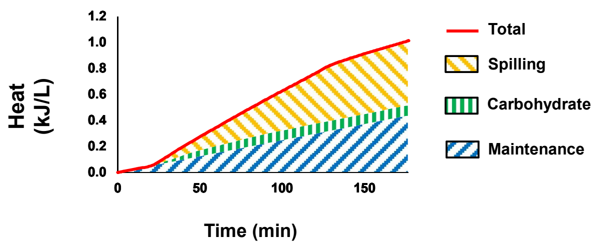
Results

Measurement of energy sinks in protozoa



Results

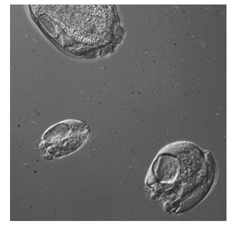
Measurement of energy sinks in bacteria



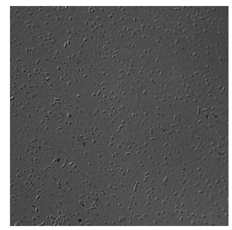
Hypothesis

- Compared to bacteria, protozoa
  - ✓ Waste more energy via synthesizing **reserve carbohydrate**
  - ✓ Waste less energy via **spilling**

Protozoa



Bacteria

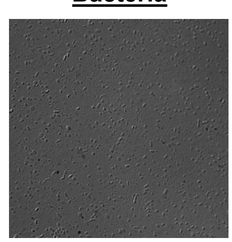


Other questions

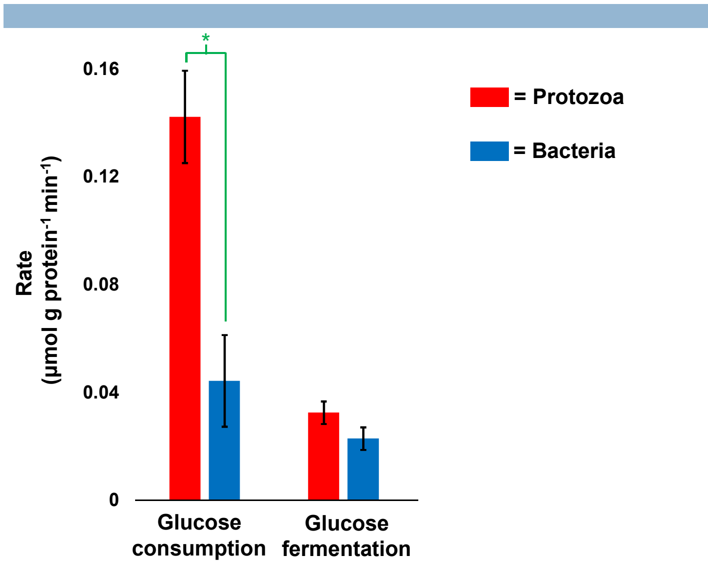
- How do protozoa otherwise compare to bacteria in using glucose?
  - Rate of fermentation?
  - Fermentation products?

Protozoa

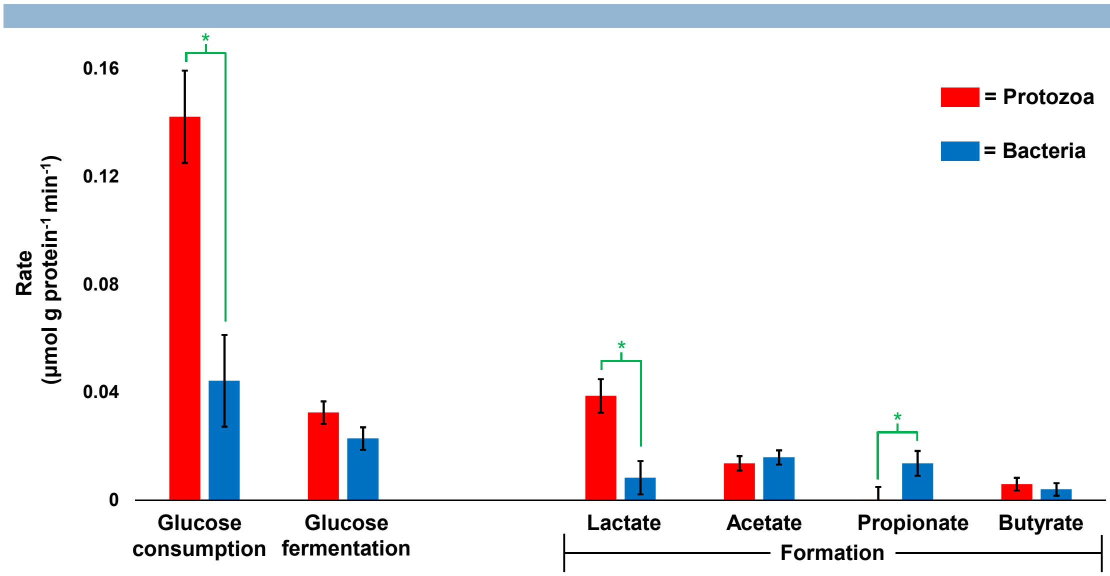
Bacteria



Results



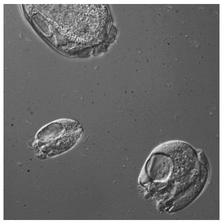
Results



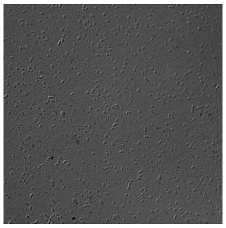
Summary

- Compared to bacteria, protozoa
  - Waste more energy via **reserve carbohydrate**
  - Waste less energy via **energy spilling**
  - Produce more **lactate**
  - Produce less **propionate**
- Data can improve microbial efficiency and reduce feed protein

Protozoa



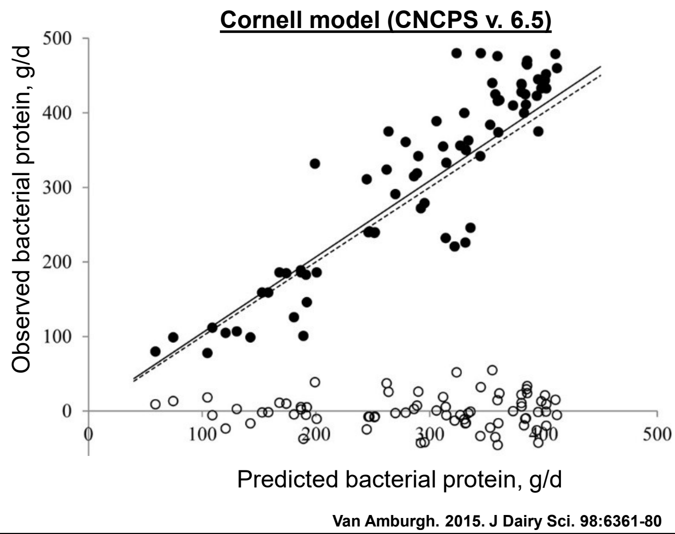
Bacteria



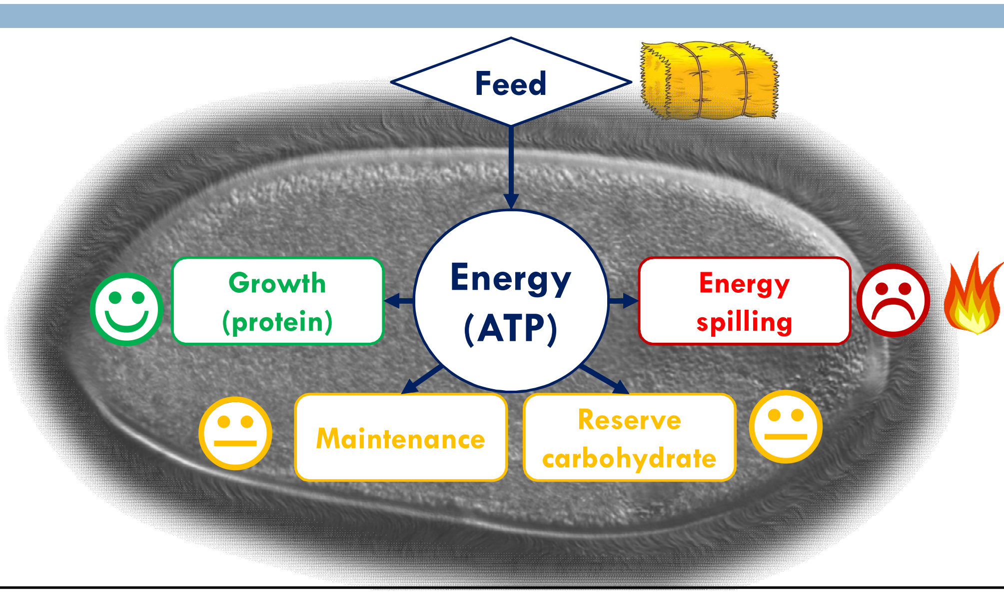
Bridging the gap

Bridging the gap

- Ration formulation software
  - Good start to predicting microbial protein
  - Still needs improvement
    - Current experiments provide key data

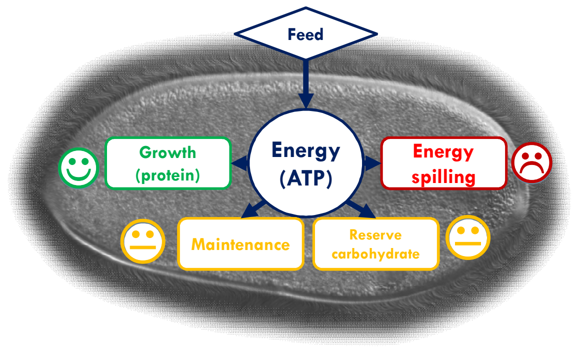


Inefficiency—cellular view



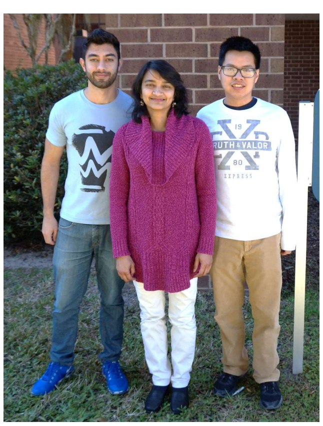
Summary

- Microbes waste up to 2/3 energy (ATP)
- Both protozoa and bacteria waste energy, but differently
  - Protozoa → Reserve carbohydrate
  - Bacteria → Energy spilling
- Measuring waste first step towards reduction
- Long-term goals
  - Improved diet formulation software
  - More microbial protein
  - Less feed protein



Acknowledgements

- People



- Funding

SOUTHEAST MILK INC

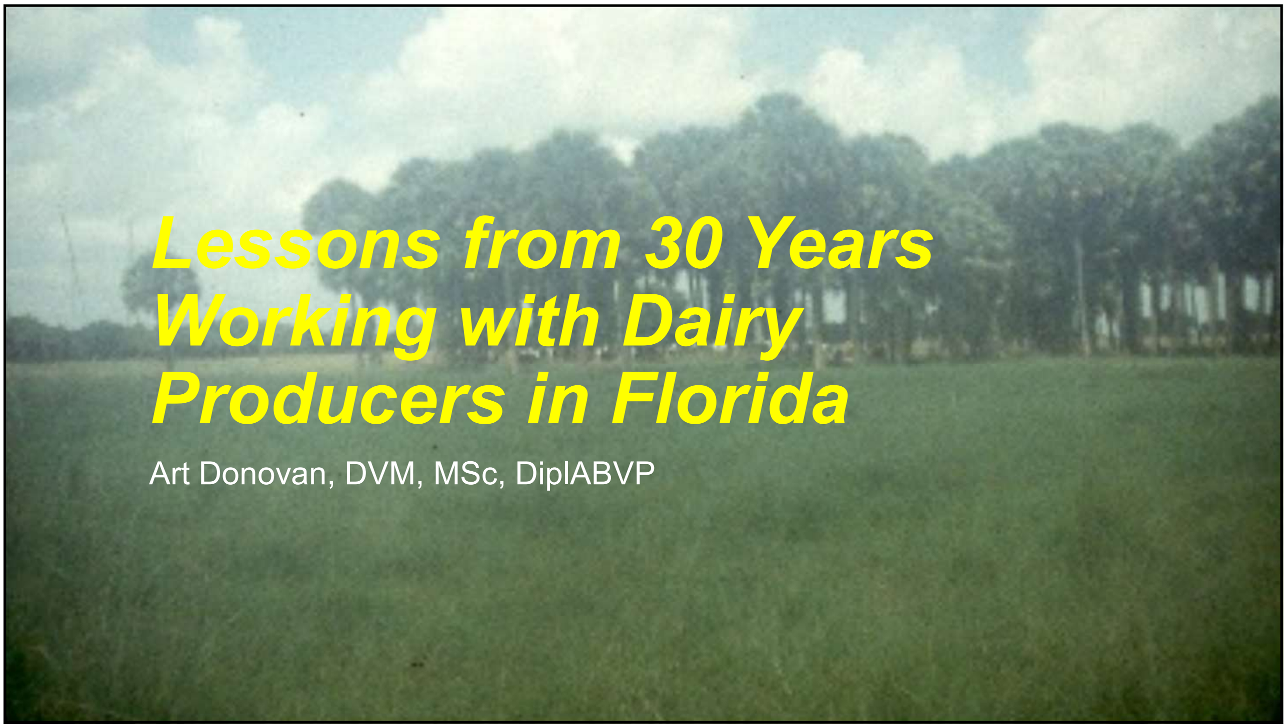
#F002995

USDA

#FLA-ANS-005307 &
#FLA-ANS-005304

CAPES

NOTES

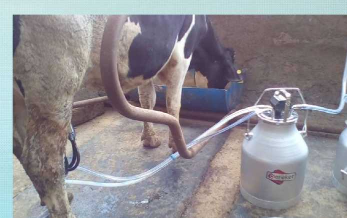


Overview

- Background Exposure
- Heros and Mentors
- Evolution of the Dairy Industry & Lessons Learned
- Science and Pseudoscience
- Acknowledgements

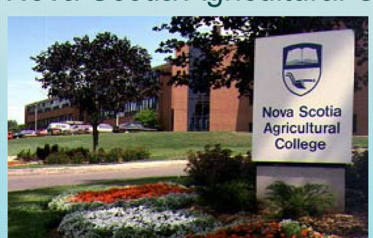
Background Exposures

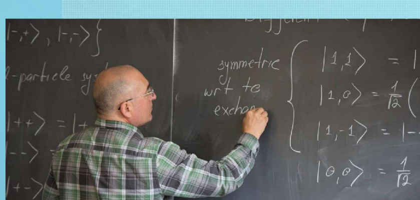
- Milking cows in high school & early college years



Background Exposures

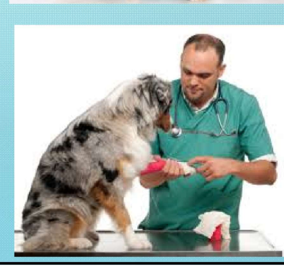
- Nova Scotia Agricultural College





Background Exposures

- Ontario Veterinary College – Guelph, Ontario



Heros and Mentors

- Heros

Dad & Mom

Patti

Heros and Mentors

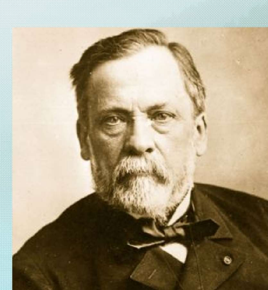
- Mentors
  - Bob Curtis
  - The Kens!
    - Ken Leslie
    - Ken Braun

My Philosophy - Dairy Veterinarian

- **Stop Look Listen**
  - **"More things are missed for not looking than for not knowing!"** Drs Francis Fox & Ken Braun

The ‘Germ Theory of Disease’

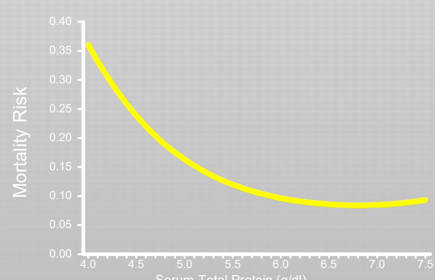
- Many diseases are caused by microorganisms.
- Organized the science of diseases
  - Disease causation
  - Vaccinology
  - Sanitation
  - Pasteurization
  - Epidemiology

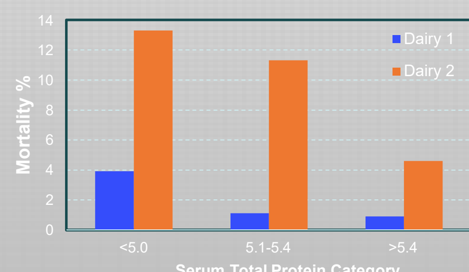


Louis Pasteur

Do I subscribe to the ‘Germ Theory of Disease’?

- It depends!
- On the organism / disease





Lessons Learned

- Florida Dairy Industry 1980 - now

Year	# Herds	# Cows	RHA Milk
1980	456	187,000	10,845
1990	300	180,000	14,044
2000	217	157,000	15,688
2010	140	114,000	16,324
2015	127	123,000	19,374
2017	**122**	**121,000**	**19,638**

Lessons Learned

- Florida Dairy Industry 1980 - now

Evolution of Dairies in Florida 1980-2017

- Diseases
- Facilities
- Feeding

Evolution of 'Diseases' in Florida 1980-2017

- Brucellosis
- IBR
- Heel warts
- Otitis media ('Ear infections')
- Bloody gut
- Mastitis

Evolution of ‘Diseases’ in Florida 1980-2017

- Brucellosis
  - 1980 - The scourge of the cattle industries in Florida
  - Test-and-Slaughter
  - Enter Dr. Paul Nicoletti
    - First-rate scientist
    - Ex-USDA employee
    - Rallied stakeholders
    - Stood up to politicians
    - Stubborn as hell!
    - Wouldn’t take ‘No’ for an answer

“This is a controllable infectious disease propagated by politicians!”

Evolution of ‘Diseases’ in Florida 1980-2017

- IBR
  - Lots of ‘shipped in’ replacement heifers
  - Lots of respiratory disease, abortions
  - In steps Dr. Ken Braun
    - Vaccinatable disease
    - Solidified replacement rearing programs → ↓ in imported animals
    - Nutrition, nutrition, nutrition!